REMARKS AND ARGUMENTS

Claims 1-3, 5-14, and 17-23 were examined in the application. All claims were rejected under 35 U.S.C. § 103 as being obvious in view of the combination of M. Brandl et al., "High Speed Signal Processing with Tapped Dispersive SAW-based Delay Lines" with U.S. Patent No. 5,987,320 ("Bobick").

All claims were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite.

The applicant would like to thank the examiner for reconsideration and withdrawal of the claim rejections under § 101 and § 102 in light of the previous response.

A. Rejections under § 112

Claim 12 and its dependent claim 13 were rejected as being indefinite because of the lack of antecedent basis for the term "the compressed equivalent signals" in claim 12. Claim 12 has been amended to overcome this rejection.

All claims were rejected as being indefinite for of the use of the term "substantially," where it is recited in claims 1, 11, and 14, that a radio frequency signal is "substantially zero between a plurality of frequency bands." The applicant respectfully traverses this rejection. The specification provides sufficient guidance to those of ordinary skill in the art as to the meaning of the phrase "substantially zero between a plurality of frequency bands."

> The signal components are non-zero in [particular] frequency bands. . . . As illustrated, elsewhere in the frequency spectrum the RF signal is zero. In actuality, noise and various other factors may result in non-zero signal components outside of the frequency bands but these signal components are often of relatively low strength. . . . Often, only the signal components about the carrier frequency and a few of the harmonics are of sufficient strength to be of interest.

Specification, p. 3. One skilled in the art recognizes that, as a practical matter, one can never achieve a situation in which a frequency component is *exactly* zero. Instead, as described in the specification, "noise and various other factors" result in signal components "of relatively low strength" that are not "of sufficient strength to be of interest." Because one of ordinary skill in the art would understand such signals to be "substantially zero," the

applicant believes the phrase "substantially zero between a plurality of frequency bands" is sufficiently definite in the context of the present specification.

B. Rejections under § 103

The applicant respectfully traverses the obviousness rejections of claims 1-3, 5-14, and 17-23. The Office Action has not established a prima facie case of obviousness against these claims because it has not articulated either why the teachings of Brandl and Bobick would be combined or how they would result in the claimed invention if they were combined.

1. There is no Reason to Combine Brandl and Bobick.

All obviousness rejections rely on the combination of Brandl with Bobick, because "Brandl does not teach representing a plurality of frequency bands in matrix form." (O.A. ¶ 11.) The applicant respectfully traverses these rejections, because there is no reason to combine the Brandl and Bobick references. In particular, the M.P.E.P. places limitations on when it is proper to combine references to make an obviousness rejection.

> VI. THE PROPOSED MODIFICATION CANNOT CHANGE THE PRINCIPLE OF OPERATION OF A REFERENCE
> If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious.

M.P.E.P. § 2143.01. Brandl discloses a solid state radio frequency transceiver whose physical structure enables filtering of undesirable components of radio frequency interference. (*See* Brandl, Fig. 1.) Bobick, on the other hand, discloses a system for testing "voice quality" by comparing voice signals with recordings of "reference sentences" such as the sentence "rice is often served in round bowls." (*See* Bobick, col. 6.)

The Office Action suggests that "Brandl and Bobick are analogous art because they are both related to the field of radio frequency (RF) signals." (O.A. ¶ 13.) The applicant respectfully disagrees. As shown by Figs. 4-9 and by Table I of Bobick, the frequencies of interest to Bobick range from about 100-4000 Hz. These are frequencies of voice signals, not radio frequency signals. While Brandl teaches a technique of rejecting interference in

radio frequency signals, Bobick teaches a technique of testing the quality of voice transmission. These references do not relate to analogous arts.

The Office Action further suggests that a combination of "the matrix representation of Bobick" and "the RF signal simulation of Brandl" would be "motivated by the desire to have 'particularly effective . . . quality evaluation of signals transmitted in the wireless communication network.'" (O.A. ¶ 14, quoting Bobick.) Again, the signals processed in Bobick are *voice* signals, not radio frequency signals, and Bobick's evaluation of voice signals is based on "research on the psychology of hearing." Bobick, col. 11 line 63 – col. 12, line 2. The psychology of hearing has nothing to do with the quality of radio frequency signals in "the industrial, scientific and medical (ISM) bands, at 2.45 and 5.8 GHz," which are the signals addressed by Brandl. (*See* Brandl, p. 171.) Brandl is designed to address the unique challenges of communicating at frequencies in which there is often substantial interference from ISM equipment (consider Brandl's example of interference from a standard microwave oven, p.172). As explained in Federal Communications Commission regulations, "Typical ISM applications are the production of physical, biological, or chemical effects such as heating, ionization of gases, mechanical vibrations, hair removal and acceleration of charged particles." 37 C.F.R. § 18.107(c) (defining "Industrial, scientific, and medical (ISM) equipment"). Thus, the combination of Bobick and Brandl would not accomplish the "quality evaluation of signals" proposed in the Office Action, and such a combination would fundamentally change the principles of operation of these references.

2. The art of record does not teach simulation of a signal that is "substantially zero between a plurality of frequency bands."

Each of the independent claims recites that the radio frequency signal being simulated is "substantially zero between a plurality of frequency bands." The Office Action relies on Brandl as purportedly disclosing this feature in Figs. 3a and 3b. (O.A. ¶ 15.) According to the Office's interpretation of Figs. 3a and 3b, only "one sub band of six is represented, with signals outside of the single band at low-strength, resulting from noise and other factors, and are essentially zero." (O.A. ¶ 15.) This interpretation of Brandl is incorrect for at least two reasons.

First, the claim limitation recites that the signal being simulated is substantially zero "*between* a plurality of frequency bands," not that the signal is substantially zero *outside* of a single band. Thus, even if the Brandl shows that "signals *outside* of the single band . . . are essentially zero," as stated in the Office Action, that disclosure is not sufficient to teach the claim limitation of signals being substantially zero *between* frequency bands.

Second, even if Brandl does refer to a plurality of sub-bands, Brandl does not show that a signal being simulated is *substantially zero* between these sub-bands. The Office Action takes the position that Brandl teaches more than one frequency band:

> Applicant appears to argue that Brandl discloses only one frequency band, as shown in Figures 3a and 3b. However, Figures 3a and 3b are merely used for exemplary purposes to teach the concept of gating. Brandl refers to "frequency bands" as "sub bands", with only "*one of six*" sub bands actually depicted in Figure 3 (that band being approximately 300 to 400 MHz).

(O.A. ¶ 4.) Even if Brandl teaches more than one frequency band, it is not correct that signals are substantially zero between those bands. In particular, it is not correct that only one of six sub-bands is depicted in Fig. 3. Instead, *all* disclosed sub bands fall within the approximately 300 to 400 MHz range of Fig. 3, and any frequencies between those bands (if there are any) have non-zero signals. This is the reason Brandl applies the prefix "sub." The sub-bands are not frequency bands *outside* the depicted 300 to 400 MHz band.

In the caption to Fig. 3b, Brandl notes that there is *gating* of "1 of 6 sub bands," not that only one of six sub-bands is displayed in the figure. A comparison of Figs. 3a and 3b shows that this gating has affected only a portion of the 300 to 400 MHz frequency band, particularly a portion between about 310 and 340 MHz. If the entire figure encompassed a single sub-band, then gating of the sub-band would attenuate the entire signal. But the strength of the remaining signal remains unchanged, peaking at around 7-10 mV/Hz both before (Fig. 3a) and after (Fig. 3b) gating. (Note the change in scale on the vertical axis between Figs. 3a and 3b.) The effect of gating a single sub-band shows that the sub-band is merely a *portion* of the band displayed in Fig. 3, not that Fig. 3 as a whole only displays a single sub-band.

Thus, as shown in Fig. 3 of Brandl, the non-zero signal extending from approximately 300 to 400 MHz extends across and between any sub-bands. The Office Action has not identified any signal in Brandl in which a frequency is "substantially zero between a plurality of

frequency bands," as required by the claims. Bobick does not disclose any simulation of signal processing, much less any simulation of processing a signal that is substantially zero between a plurality of frequency bands. Thus, Bobick does not overcome the deficiency of Brandl, and no prima facie case of obviousness has been established.

3. The art of record does not teach simulating processing of a plurality of frequency bands in a single matrix.

Claim 2 recites that "information in the matrix representation of the radio frequency signal is limited to information of the signal in frequency bands of interest," where, as recited in parent claim 1, there is "a plurality of pieces, each piece representing a frequency band." This claim was rejected on the ground that Brandl teaches that there are two "scientific and medical bands, at 2.45 and 5.8 GHz." The existence of these two bands merely shows that they are *available* for communications. There is no suggestion in Brandl of using *both* of these bands at the same time, or that one should create a matrix representation that includes both of these bands. As Bobick does not disclose any simulation of signal processing, it does not overcome the deficiency of Brandl.

4. The art of record does not teach non-linear operations on a matrix.

Claim 1 recites that processing of the matrix "simulate[s] operation of the radio frequency processing circuitry on the radio frequency signal," and claim 3 further limits this to a case in which "the processing simulates non-linear operations" In rejecting this claim, the Office Action relies on equation 3.1 of Brandl. That equation does not reflect processing of a signal. Equation 3.1 simply describes the waveform of the signal itself, *before* it is subject to any processing. As described on page 171 of Brandl, the device being studied comprises "linear" radio frequency processing circuitry, not circuitry performing non-linear operations as claims. Thus, there is no disclosure in Brandl of simulating non-linear operations on a matrix representation of a signal. Because Bobick does not disclose any simulation of non-linear circuitry, it does not overcome the deficiency of Brandl.

5. The art of record does not teach processing of harmonics.

Claims 9 and 12 recite that the signal is centered about a carrier frequency, and the frequency bands of interest include harmonics of the carrier frequency. This is not disclosed in Brandl. Brandl discloses the use of a signal centered at around 350 MHz (see p. 176, where f_0=350 MHz). If this is considered to be a carrier frequency, then its harmonics would be at, for example, 700 MHz, 1050 MHz, 1400 MHz, etc. There is no suggestion in Brandl that frequency bands in these ranges are being processed. The rejection of claim 9 in the Office Action suggests that the signal of a "jammer" is a harmonic of the carrier frequency. The "jammer" signal of Brandl, however, is 370 MHz (*see* p. 176), which is not a harmonic of a 350 MHz signal. Because Bobick does not disclose any simulation of signal processing, it does not overcome the deficiency of Brandl.

6. The art of record does not teach a bandwidth-limited matrix representation.

Claim 13 recites that the "radio frequency signal is bandwidth limited and the matrix representation is bandwidth limited." This claim was rejected in light of Brandl's disclosure that when a tap is gated, "signals within its bandwidth are heavily suppressed." (O.A. ¶ 26.) This ground for rejection cannot be correct. Claim 13 recites bandwidth limits on the *representation* of the signal, not on the strength of the *actual* signal. Indeed, Brandl *must* simulate signals within the bandwidth of the gated tap: without simulating those signals, Brandl would not be able to determine that those signals were heavily suppressed. The matrix elements of Bobick, far from being limited to particular bandwidths, actually *overlap* in their frequency coverage. *See* Table I.

7. The art of record does not teach performing convolution in the frequency domain.

Claims 19 and 23 both recite techniques of performing convolution in the frequency domain. This is done by converting a frequency-domain representation to a time-domain representation and multiplying in the time-domain representation. In rejecting these claims, the Office Action relies on Brandl's disclosure of convolving "the impulse response h(t) with the received signal $s_j(t)$." In the functions representing the impulse response h(t) and the

received signal $s_j(t)$, however, the dependent variable is the *time*, t, indicating that Brandl is performing time-domain convolution, not frequency-domain convolution. Accordingly, Brandl does not teach the claimed techniques of performing frequency-domain convolution. Bobick does not describe any use of convolution and thus cannot overcome the deficiencies of Brandl.

C. Conclusion

The rejections under § 112 are believed to have been overcome. Moreover, because the combination of Bobick and Brandl would not be motivated by the prior art, and because the claimed invention would not result even if such a combination could be made, the applicant respectfully requests reconsideration and allowance of the pending claims.

Respectfully Submitted,

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